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ABSTRACT

This paper reviews the current extent of, research into, and future expectations for the use of online bibliographic retrieval systems by untrained end users rather than by trained search intermediaries. Six sections cover: (1) studies of direct end user searching, done primarily with students or persons in highly technical fields; (2) problems to be addressed before end user access can become common practice, including the variability of search procedures and the user's possible lack of computer, online searching, and information seeking experience; (3) suggested solutions to these problems, including standardization of online search procedures, training of end users, and the development of user-friendly system modifications; (4) methods and systems currently used to train novice online users, including TRAINER, DIATOM, and IIDA (Individualized Instruction for Data Access); (5) current research into user-friendly system modifications, with descriptions of VSS (Vocabulary Switching System), CONIT (COnnector for Networked Information Transfer), IIDA, TSW (The Searcher's Workbench), PaperChase, MICROsearch, CITE (Current Information Transfer in English), and OL'SAM (Online Search Assistance Machine); and (6) projections concerning the future direct use of computer information systems. A 54-item bibliography is provided as well as a 38-item annotated bibliography of ERIC publications and information on how to order ERIC documents. (ESR)

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INTRODUCTION

The use of computer systems for locating information sources (as well as for information itself) is becoming more and more widespread. What was originally thought to be a tool exclusively for researchers and subject specialists is becoming increasingly available to lay persons. It is therefore highly appropriate to take a look at online information systems in the light of direct interaction with "naive" or "novice" users. This paper reports on the use of online bibliographic retrieval systems by untrained end users--the present state, research efforts, and what we might expect in the near future.

"An information retrieval system is one in which a user can, via computer, directly interrogate a machine-readable database of documents or document representations" (25). Online bibliographic systems, analagous to non-mechanized indexes, are access tools directing the user to appropriate sources by providing citations, and in many cases, short descriptions (i.e., abstracts) of documents. Bibliographic systems do not provide the user with the contents of documents as do knowledge-based (also called full-text or expert) systems. Full-text is a major consideration in future online information provision, but beyond the scope of this paper.

End users are those who will actually be using the information, not necessarily the persons who conduct the search online. Untrained end users may be subject experts, but they may not have the familiarity, training and skills presently associated with searching and retrieving information from computerized systems. Currently, the direct use of online retrieval systems is primarily performed by trained search experts. End users supply questions and interact with professional online searchers who formulate strategies and then search appropriate online databases. It is the expert intermediary who directly uses the online system.

Many predict that this situation will change and that "'end users' of information systems (library patrons, students, etc.) will input their requests and receive output without the assistance of a trained intermediary. . . (and that) . . .an important application problem for the 1980's will be the adaptation of on-line computing and micro-computing to the information tasks of everyday life" (37). The browser who is unclear as to exactly what he is seeking, the student working his or her way through a particular subject area, and the

person looking for sources who (for whatever reasons) is reluctant to consult library or information professionals, are all potential direct users. End user searching has been tested and found feasible in a number of settings (described below). It is inappropriate as well as short-sighted to expect users to turn to intermediaries in all search situations.

STUDIES OF END USERS

The small number of studies concentrating on direct end user searching have involved mostly students (undergraduate and graduate) or persons in highly technical fields. Fenichel's study (14), perhaps the most extensive, sought to identify differences among searchers (1) of varying amounts of overall experience (including none), and (2) with or without experience on the particular data base being searched. Using students in an introductory library and information science class, she found that "compared to the experienced subjects, beginning searchers performed surprisingly well," particularly as measured by precision (an indication of accuracy obtained by dividing the number of relevant references retrieved by the total number of references retrieved) (14, p.23).

It was clear that novices did search more slowly and make more errors than experienced searchers. In addition, experienced searchers performed higher on a recall measure (an indication of comprehensiveness derived by dividing relevant references retrieved by the total number of relevant references in the data base) and unit cost (a measure of cost-efficiency derived by dividing connect time by the number of relevant references retrieved). Fenichel's results do confirm that for a straightfoward topic, untrained users can successfully access an online database and retrieve relevant documents. As searches become more complex and/or comprehensive, the advantages of utilizing a skilled professional are more apparent.

The university environment, not unexpectedly, has provided subjects for other studies. Lowry (26) found novice information retrieval students performed better with full-semester training vs. a short training seminar; Brooks (4) found upper division and graduate students in the biological sciences enthusiastic and capable after a

training course; and Stevens and Schneiderman (47) used university undergraduates to study alternative written training aids for SCORPIO, the Library of Congress retrieval system.

There have been studies in "real world" settings to determine the feasibility and effectiveness of direct end user searching on a casual, demand basis. Richardson focused on scientists and engineers (at the Raytheon Company, Submarine Signal Division) and discovered, much to his surprise, that while all participants were able to use the system successfully, "the levels of usage were ... astonishingly low ... even more so when one reflects that the first seven months of the project were essentially absolutely free" (38, p.49). Richardson speculated that perhaps the users simply did not have a need for a new source of information, that simply having a powerful new tool available will not necessarily change the engineer's information gathering patterns.

A recently reported study by Judith Haines, also conducted in a high technology environment, directly contradicted the Raytheon results. She found that " the Kodak chemist/searchers continued to use their online search capability.... Within two years 8 of the 77 laboratories in the Rochester Research Laboratories acquired online search capability" (17, p.18). Successfully accessing very specific and well-organized data bases (Chemical Abstracts and chemical dictionary files), the chemists "found it very useful and convenient to find references to preparations without going to the library or having to explain their needs to an intermediary" (17, p.17).

"PaperChase" (10; 19) was an effort to make an online data base available to health professionals. Using computer tapes prepared by the National Library of Medicine (NLM), Horowitz and Bleich developed a computer information system which accommodates all journal references in the Beth Israel (Boston) Hospital library. The system was designed for self-service, 24-hour search capability, and relies on online search assistance rather than a printed manual. "During the first year of deployment, untrained users, without help from a search librarian, performed 8,459 PaperChase searches--more computerized searches of general medical literature than at any other medical library in the country" (19, p.930). While 26% of the users reported that they were uncertain or did not find what they were looking for, these negative results decreased with online experience.

PaperChase is more limited in scope than most online bibliographic services (i.e., it includes only the journals in the hospital library), and is related to the efforts to develop online public catalogs, the computer-based equivalent of a library's card catalog. Although beyond the scope of this paper, research and development of online public catalogs involves features and issues similar to those of the projects described in this paper, e.g., screen format, user control, training, and online user assistance. Online public catalogs are, in fact, the first large-scale situations where end users search directly. For discussions of approaches involving online catalogs refer to Kaske and Ferguson (23), Mandel (27), Ferguson (15), and Horny (18).

With the exception of Richardson, the studies cited above generally report that non-professional searchers are interested and enthusiastic about conducting their own searches. Many users prefer the convenience and speed of searching directly for short, fairly specific information needs. The studies also support the contention that end users can search with some success, albeit not to the levels of efficiency and comprehensivess of professionally-mediated searches.

PROBLEMS

While the above research indicates the potential for direct online searching, the actual use of online bibliographic data bases by untrained users is severely limited. There are serious problems to be addressed before end user access can become common practice.

Major difficulties arise from the proliferation and variability of online systems and data bases, specifically the multiplicity and inherent complexities of access procedures, command languages, indexing vocabularies, data base structures, search and retrieval functions, and output formats. A user is presented with a choice of potentially appropriate data bases and systems, but each database to be accessed has unique sign-on procedures, differing command words and grammar, and a varying range of allowable search options. "With controlled vocabulary, free text, combinations of both, subject categories, and variations in indexing philosophy over the data bases,

the richness of options can confuse even skilled operators" (34, p.308).* Regarding user problems, the naive end user may suffer from lack of computer experience, lack of online searching experience, and lack of information seeking experience in general. "In the current set-up, many problems can be encountered while searching. A basic understanding of the principles of searching increases a user's chance of efficient and economic operation. The searcher should have some appreciation of . . . (a) characteristic of the system, (b) characteristics of the different databases, (c) differences of a controlled language and a natural language approach, (d) understanding of the various logical approaches that are available" (34, p.296). In addition, occasional or novice end users do not have professional-level expertise in key word generation (the use of terms which accurately represent the topic to be searched), boolean operator manipulation** and, especially, search strategy formulation, all of which are necessary for successful negotiation of complex search mechanisms.

SOLUTIONS

A logical first suggestion to overcome some of the difficulties would be some standardization within the field. In 1978, Atherton called for the formation of a subcommittee of the American National Standards Institute "to concentrate our attention on developing

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*Controlled vocabulary refers to the use of search terms from a predetermined list (thesaurus) of acceptable words. Free text is searching with no controlled vocabulary and usually includes scanning all fields in the citation with subject-content, e.g., title, abstract, note, identifier. Natural language refers to the use of free-form language (e.g., common English words and phrases) in searching.

**Based on the Boolean system of symbolic logic, the three basic Boolean operators (AND, OR, NOT) are used in online searching to link the various concepts. For example, connecting ("gasoline" AND "price") AND ("United States" OR "Mexico") would retrieve items concerned with the price of gasoline in the United States or Mexico (5, p.24-25).

standards for the 'technical terms and symbols' used in the four functional areas of interactive retrieval systems" (9; 1, p.60). This was not an attempt to make all systems "uniform," but rather, "should help to reduce some of the diversity in conventions, symbolizations and codes used for search query commands, output and system control, and possible instructional features of interactive retrieval systems" (1, p.60). The subcommittee (Z39-G) has recently completed a draft of recommendations and is awaiting completion of similar work by a European group (ISO TC46/SC4/WG5). The two groups intend to confer early in 1983.

Research efforts aimed at direct end use have reflected both the user and system nature of the problem by focusing on the education of end users and/or various user-friendly system modifications. Added to the basic research and development task is the burden of implementing system modifications or online training modules without direct access to the equipment and retrieval software of the vendors offering the online search service.* Here the utilization of mini- and microcomputers has proved crucial, allowing researchers to design and test a range of alternatives from more "user-cordial" interfaces (where the part of the computer system that interacts with the user is more flexible, requiring less preciseness in command input and usually providing greater assistance to the user) to conversions of the normal Boolean search facilities. In spite of certain limitations--e.g., computer capabilities, transmission speed, and continued reliance on host (vendor) system facilities (21, p.50-51)--the development of mini- or microcomputer-based "intelligent terminals" has already been a major factor in information retrieval research efforts.

EDUCATION OF USERS

One popular approach to improving the situation is to have the end user gain familiarity with online information capabilities and

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*Often called commercial search services, online utilities, or data base vendors, these are the organizations that offer access to one or more data bases by providing all of the necessary computer operations and support services. The three major commercial services are BRS, DIALOG, and SDC (5, p.32).

some proficiency with commands, search strategy, and basic boolean search operators. The user is expected to learn how to query the system successfully in order to retrieve relevant information. "A basic understanding of the principles of searching increases a user's chance of efficient and economic operation" (34, p.496).

In the late 1970's, BIOSIS, a non-profit, discipline-specialized database producer, in conjunction with other indexing and abstracting services, began studying various educational strategies in relation to the utilization of online databases by both intermediaries and end users. Findings were positive regarding the potential for end users and included recommendations about the importance of motivational elements and the need to develop meaningful end user programs (12).

A common method aimed at raising the level of end user expertise has been the online tutorial program designed to teach search skills and provide familiarity with the various languages, structures, and procedures. Caruso's TRAINER, an online training package developed at the University of Pittsburgh, provides for practice by potential users of DIALOG and SDC. Along with an economical setting, TRAINER offers specific modules to guide learning in terminal telecommunications protocols and access procedures" (6, p. 28). TRAINER is intended to be used either independently or in conjunction with formal classroom instruction. Caruso makes a strong case for using online instructional programs to train unskilled users as well as to extend the "population of knowledgeable users" of online services (7).

The DIATOM simulator developed at Syracuse University by Robert Waldstein has the similar objective of providing online teaching opportunities and experience without the expense of access through commercial utilities (52). DIATOM offers a search system and user interface very close in operation to DIALOG and a choice of data bases. Although this allows inexperienced searchers to spend extensive time using a retrieval system similar to those presently available commercially, DIATOM does not lead or guide instruction.

Meadow's IIDA (Individualized Instruction for Data Access) project is committed to the objective of enabling "end users of bibliographic information to perform their own searches under certain circumstances" (30, p.326). Operating as an intermediary between the end user and the online system, IIDA has both online assistance and pre-use training capabilities.

The "instructional mode" of IIDA consists of two teaching exercises utilizing a simplified form of computer-assisted instruction, interspersed with actual searches. Topics covered include basic commands, advanced commands, text searching, search strategy, database descriptions, beginning and ending the search, and IIDA facilities (30, p.327-328). The role of the instructional mode is integrally tied to the overall IIDA package (described in detail below), and unlike TRAINER, does not include instruction in telecommunications and access procedures.

Studies of the relative effectiveness of any particular training methodology have been generally inconclusive. In addition to the computer-assisted packages described above (see also Tilley (49)), methods range from written training aids such as those developed for SCORPIO, the Library of Congress retrieval system (45), to a combination of instructional sessions, worksheets, and lab exercises (3, 4, 12, 17, 26). Each of these approaches has met with a degree of success; however, it is not possible to make definitive statements about the value of one vs. another. Even in a situation where training was minimal (Tietelbaum and Sewell's survey of pathologists and pharmacists), over half of the respondents felt their searching ability to be competent (48, p.300)! It is questionable whether more specific investigation to determine those methods that are truly more effective (as well as economical) can ever yield conclusive results. For more discussion on education and training efforts, refer to Bourne and Robinson's comprehensive review through 1980 (3).

SYSTEM MODIFICATIONS

The alternative to raising the level of end user ability is to somehow make the system itself more capable and "user-friendly." In their work for the National Library of Medicine (NLM), Goldstein and Ford (16) utilized an "intelligent terminal" (a computer with a microprocessor physically incorporated into the terminal) to make the system more "user-cordial" rather than having the user "conform to rigid protocols and learn special codes." Selander pointed out that system designers need to consider (1) user objectives, (2) current procedures, (3) tutorial aids, (4) system organization, and (5) machine intelligence in order to improve system cordiality (43, p.66). The overall objective should be to provide users with a system which is

neither intimidating nor frustrating, but able to accommodate varying levels of user sophistication, and which facilitates quick access.

Believing that heterogeneities (i.e., the differences in indexing languages and underlying indexing policies) are the major obstacles to more intelligent and more effective use of online services, Niehoff devised the Vocabulary Switching System (VSS), an automated subject switching system "able to translate user requests into useful search queries across target databases with little user intervention" (32, p.397). Niehoff reports that while initial evaluation results for VSS were encouraging but inconclusive, they did support the assertions that no single data base is authoritatively sufficient, and significantly higher recall is possible when one searches multiple data bases.

Marcus and Reintjes (28) also focused on the problems generated by multiple and complex online retrieval systems. They proposed a solution which involved the accessing of online utilities and data bases through a computer interface (CONIT) designed to handle both access and vocabulary problems. "The interface is . . . a common system into which and from which requests and results are translated automatically as they flow between user and serving system. . . . A user attempting to retrieve information, when entering through the access mechanism provided by the common interface, sees a single virtual system in which all the complexities of the different retrieval systems and databases are hidden; only a single, uniform, easy-to-use system is apparent" (28, p.288).

The CONIT system handles different existing, stand-alone online data base systems without modification and replaces existing, difficult-to-use heterogeneous interfaces with a simpler, easier-to-use interface. In addition to the controlled-vocabulary search mechanisms of existing systems, CONIT also provides a natural-language, keyword-stem approach for searching. This allows the searcher to enter any term (word or phrase in free-form English), not just those included in a special, restricted vocabulary. The system modifies the entry by using only key words from a phrase and word stems rather than full words. Natural language searching is one response to the problems associated with the multiplicity of vocabularies, structures, and search functions of individual data bases and retrieval systems.

Experiments with CONIT resulted in the overall conclusion that inexperienced end users can use a translating computer interface sufficiently well to retrieve relevant documents from a network of heterogeneous systems in reasonable time. The project also provided strong support for the hypothesized statements that search strategy formulation is a key for successful searching by inexperienced users, and that a free-vocabulary-based keyword/stem approach to search strategy formulation is an effective approach (28 p. 311).

The IIDA project (30) does not address the problems associated with heterogenous systems, attempting instead to improve user cordiality through an "assistance mode." Here the system acts as an "intelligent assistant" or "computer coach" monitoring and appraising the search, examining both commands and responses, looking for errors or indications of problems.

Because each search is unique, IIDA cannot prescribe how a particular search should be conducted. However, since it does have information about correct syntax, about searches in general, and what has been the history of the current search, IIDA can react by offering suggestions on how to proceed in the context of the error or problem encountered. IIDA employs a set of diagnostic procedures, and when a problem is detected can "(1) inform the user of the nature of the problem, (2) offer advice on what to do next, and (3) offer a reminder of what reference information is available concerning this specific problem" (30, p.327-330). In addition, the system has an extensive HELP facility allowing the user to request quick advice, a search summary, more detailed information, or the option of changing IIDA modes (e.g., from assistance back to instruction). IIDA currently runs on the MIT MULTICS computer system and CONIT software (described above); however, it could be adequately handled by a minicomputer such as Digital's PDP-11 (29, p.58).

Preece and Williams (36) have proposed a microcomputer-based intelligent terminal able to offer uniform access to multiple data bases with many of the desirable features previously described. "The Searcher's Workbench" (TSW) is designed to make the user unaware of the operational differences among online systems and data bases (i.e., the differences are unseen or "transparent" to the user), offering instead a single, uniform front-end (the part of the online system with which the user interacts) for online searching. Central to TSW is the definition of a "model search system." User input is analyzed in terms of the pre-defined model and then altered to the specific

language required for specific database systems. Limitations of individual real-world systems are handled by modifications to the model. In addition, user aids are incorporated into the model offering the user direct access to search-enhancing and tutorial aids.

TSW was clearly designed from a user's perspective. Users are presented with a single, simplified system bolstered with assistance capabilities; however, experienced users are able to bypass the structured system and conduct standard boolean searching on multiple data bases. Users are also afforded the advantages of touch panel input. For most procedures, rather than entering commands and responses by typing on the keyboard, they can simply touch indicated areas of the screen.

To date only a prototype TSW (PTSW) has been built. This comprises a loose configuration of hardware devices, not just one piece of equipment. A production-model TSW (with the same goal of "implementation of access to diverse search systems through user interaction with an ideal model search system") would be a single unit or a cluster of terminals sharing a central processor (35, p.404). Preece and Williams also foresee the possibility of a TSW operational software package adaptable to many popular microcomputers being available commercially in the near future.

Similar to IIDA and TSW in providing online search assistance is PaperChase, mentioned earlier. PaperChase has the capability for monitoring the search in order to make recommendations for improvements, usually by suggesting (additional) search terms. Since the available database is a subset of the MEDLINE data base, the use of a MeSH term (i.e., a term from the controlled medical subject heading vocabulary) can greatly enhance chances for success. The program encourages the user to type whatever seems appropriate, removes blanks and punctuation, and attempts to match input to MeSH terms and rotated versions of MeSH terms. In this way the system presents alternative search terms which the user can utilize. PaperChase also provides online help facilities, sorted display (most recent items appearing first), and sorted output (listed in the order that journals are shelved in the hospital library) (19).

A project which also relies on a subset from the tapes of a large data base is MICROsearch, developed by Bruce Clark at the ERIC Clearinghouse on Information Resources, Syracuse University (8). Directly aimed at the audience of non-professional searchers,

MICROsearch is unique in being based totally on a small microcomputer system (initially the Apple II Plus with one disk drive). Small subject-related files from the ERIC data base are transferred (by a process called "downloading") to the 5¼ inch diskettes used by the Apple system. The user, possibly a school librarian, teacher, or even a student, does not need to connect to any commercial data base utility as the database and MICROsearch software are both provided on the "floppy" diskettes. Another key component of the project is the user interface. The formatted screen (with certain information always appearing on display) is designed to simplify the search process and partially guide the user through the search.

The major difficulty in providing stand-alone databases on a small microcomputer system is the limited storage provided by the 5¼ inch diskette. There is only room for between 200 and 300 records per disk, and when a particular subset of ERIC required using many diskettes, users were frustrated by the failure to retrieve anything on disk after disk. One approach to overcome this has been the move to subject-related sets of disks rather than simply dividing them into sets chronologically. Another attempt to compensate for the limited storage space is the RE-EXECUTE feature whereby the RX command allows for automatic "re-execution" of previously used search terms (along with associated logical operators) on multiple disks. As diskette storage capacity increases and as more sites acquire hard disk drives, the overall problem should diminish.

Current efforts involving MICROsearch include working on the space problem, refining the programming, and making the system available for other microcomputers. In addition, field testing uncovered two needs: (1) the ability to create local files that can be searched with MICROsearch, and (2) an interface designed to facilitate learning to search which can adapt as the user grows in sophistication (i.e., as the user is able to exercise more control, the interface does less). The local files capability is already available and design of the interface is underway.

The promising research efforts described above have been aimed primarily at providing a means of educating and/or assisting the user in maximizing the benefit obtainable from existing boolean systems. Acknowledged, but not confronted, is the question of what would happen if the boolean mechanism itself were replaced. Salton (41, 42), van Rijsbergen (51), Sparck-Jones (45, 46), Oddy (33), Preece (35), Kraft (24), and others (2, 39, 40) have been investigating search

mechanisms as alternatives to the traditional boolean approach now present on operational systems. Clustering, vector spaces, weighting, probabilistic indexing, relevance feedback, and other mechanisms have been studied and found to perform with varying degrees of success in controlled laboratory settings.* A major difficulty in assessing the full performance of a given approach (even as measured by recall and precision) has been the problem of experimenting in a "natural" environment, i.e., using actual searches conducted on operational systems (e.g., DIALOG, SDC, BRS).

One prototype system which does demonstrate the possibility of an alternative search interface for an operational data base--the National Library of Medicine's MEDLINE--is CITE (Current Information Transfer in English). Developed by Doszkocs, CITE offers natural language query capability along with weighted and ranked output, relevance feedback, and automatic query modification.

Natural language allows the user to enter search items in free-form language, rather than being limited to a special command syntax and search vocabulary. Document citations retrieved are weighted by the "number of query terms shared by a given citation and the relative frequency of such terms in the MEDLINE file" (11, p.135). The entries are displayed in decreasing order of importance as determined by the weighting. Through relevance feedback, the CITE user is able to offer a judgement as to actual importance, thereby refining the search, since modifications of the search query are made by the system based upon the characteristics of the

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*Clustering refers to a mathematical process whereby documents are grouped together as members of clusters. Vector spaces, a concept from linear algebra, can be used for representing distances (i.e., closeness) among documents in a collection. Weighting is the practice of assigning weights to search terms to indicate their importance. Probabilistic indexing uses a measure of term importance to indicate the likelihood that a term should be assigned to a given document. The probability measures can be used as term weights and documents can then be retrieved in rank order according to the probability of relevance to a given query (42, p.422). Relevance feedback takes user reactions to documents (relevance judgements) and returns them to the search mechanism in order to improve retrieval.

documents deemed relevant by the searcher. Through these processes, the online system is flexible and responsive to the searcher, rather than always placing the burden on the user to initiate, generate terms, and modify the search. "Although the capabilities of the present prototype are very basic, the CITE system has considerable potential for overcoming the inherent limitations of existing user interfaces and making possible online searching without the need for trained intermediaries" (11, p.136).

Jamieson and Oddy have proposed using a microprocessor-based intelligent terminal to implement alternative search capabilities and test them in real situations. They contend that "a number of non-boolean techniques can, in fact, be transformed into sequences of boolean operators without requiring any more information from the host system than can be obtained using commands which are available to the ordinary searcher" (22, p.202). The intelligent terminal pre-processes a user's query, presents search requests to the commercial system in an acceptable format, and post-processes the information before displaying it to the user. The user is as unaware of the original search mechanism of the host as the host is of the mechanism offered to the user. An intelligent terminal was constructed based on an 8-bit microprocessor (21), the use of which complicated the implementation enormously. The currently available powerful, high quality, 16-bit microcomputers are more suitable for the task.

FUTURE DIRECTIONS

The use of computers by lay persons has mushroomed far beyond early forecasts and similar growth can be predicted in the direct use of computer information systems. Meadow has projected the pattern of development in computer programming to online searching, stating that end users "will become like modern amateur programmers, able to handle routine problems on their own, needing the help of specialists when they get beyond the elementary level" (31, p.52). The problems associated with direct end use (i.e., the multiplicity and complexity of systems, databases, access and command procedures, indexing vocabularies, database structures, search functions, and output formats; the inexperience of users in online searching and information seeking) have been described in this paper. Likewise, the

approaches taken by researchers and designers (i.e., training; standardization; a single, switching interface; online assistance; user-friendly screen design; down-loading; enhanced search capabilities; and alternative search mechanisms) have been outlined by focusing on various experimental systems. While no single effort has provided a total solution, the reported results point to promising areas deserving continued or expanded study.

In the future, a number of systems (database management, full-text, and expert, as well as bibliographic) will be employed by end users to meet information needs. To this end, interaction must be flexible and "user-friendly"--a goal already accepted by many concerned with the development of these systems. Researchers in information retrieval must continue to build on the efforts described in this paper as well as to expand their concerns beyond bibliographic systems.

The experimental work with intelligent interfaces has shown the feasibility and effectiveness of utilizing a computer as intermediary. Research on users (i.e., cognitive models, search strategy, and query formulation) and machines (e.g., artificial intelligence and memory capabilities) is needed to provide a basis and guidance for development. Further design and testing of specific systems is warranted to fully explore the capabilities of intelligent terminals, alternative hardware/software combinations, the impact of changes in interface design, and the effectiveness of certain features with specific user groups.

Future efforts to make online systems more accessible to occasional users must take into account the potential for applying results from artificial intelligence research. "Artificial intelligence (AI) is a branch of computer science which attempts to develop programs to enable compter systems to communicate fluently, to explain why they have taken certain actions, to handle unforeseen situations, and to exhibit other similar signs of intelligent behavior" (Sandewall; in 44, p.384). Application of AI techniques for pattern recognition, representation, problem solving, and learning can help in making system languages easy for the user to understand, and in creating systems which relieve users of unnecessary chores (44, p.385). While acknowledging the progress represented by IIDA and CITE, Smith makes a strong case for employing artificial intelligence techniques in these efforts and in future designs.

Analysis of query formulation and search strategy involves examination of the approaches taken by users to the tasks of defining information needs and locating relevant sources. For example, both IIDA and TSW offer online assistance to users by monitoring the search. To do this effectively, the system must have some model with which to compare the current search. Identification of recognizable patterns or models of users could improve the monitoring capabilities, and, in turn, the assistance capabilities of these intermediary systems. An equally interesting question is the relative effectiveness of certain search techniques or tactics. Identification of particularly effective strategies or techniques has implications for systems (e.g., possible features to incorporate into a system), as well as for training programs.

The creation of market-ready versions of experimental systems offering a range of switching, aid, and tutorial features should ease and simplify access and provide options for users with varying levels of sophistication. One of three early ventures into this area, the Franklin Institute's OL'SAM (Online Search Assistance Machine) (50) is a commercial, microcomputer-based, front-end processor related to the CONIT and IIDA projects. OL'SAM offers a variety of assistance (e.g., auto logon, help paragraphs, prompting) and strative features (e.g., a single command language, searches ed on disk, and administrative log) as a software package for North Star Horizon II. Although the differences and changing ture of host systems have caused some problems, OL'SAM demonstrates the viability of a commercial product and others can be expected to follow.

The microcomputer-based, self-contained system demonstrated by Clark's MICROsearch offers a locally controlled online capability that should increase in appeal. Whether using downloaded subsets of large databases or locally created files, MICROsearch offers real online information opportunities for non-professional searchers. System usefulness will grow with more widespread use of larger memory devices and increasing capacity of existing storage structures. The work on an adaptable interface, effective for users with varying amounts of experience and sophistication, has widespread application in the development of systems and training of searchers.

The research efforts using an intelligent terminal to investigate alternatives to boolean or modified boolean search mechanisms (e.g.,

various relevance feedback mechanisms), as described by Jamieson and Oddy, also merit continued investigation. The ability to test alternative mechanisms in real settings could result in definitive statements about performance.

Regarding the training of end users, studies of various instructional approaches have found each to be useful in improving performance. Online tutorials, manuals and handouts, formal instruction and workshops, and even just trial and error, all appear to be reasonable techniques. Although study in this area is likely to continue, it is doubtful whether definitive, comparative results are possible.

And, finally, studies of untrained end users must expand beyond undergraduate students, graduate students, and persons only in highly specialized areas. As database services expand to include more sources of interest to the general public, the full range of potential users must be taken into account. While journals have reported on the popular use of online information services (mostly commercial information utilities, e.g., The Source, Dow Jones, Compuserve, BRS After Dark, DIALOG's Knowledge Index) by home computer enthusiasts, little has been done to formally analyze this group or other more "general" direct users.

Even high school students are beginning to interact with online systems, e.g., the availability of the Guidance Information Service (GIS) in many secondary schools. Wozny (54) reported on a study by Drott and Mancall where high school students used online bibliographic searching and conventional searching to obtain information for an independent research assignment. Results were surprising in that the online searches resulted in few references in the students' bibliographies, although it appeared that online searching played a key role in meeting the objectives of (1) making students aware of the diversity of institutions and sources that supply information, and (2) providing new opportunities for assisting students in developing search strategies. More investigation into the abilities, attitudes, and approaches of this group of users is needed.

In the future, there will be a myriad of computer and information systems available to a range of users. The research, development, and design projects described in this paper are just a beginning. The goal for information and library professionals remains the same: to put patrons in contact with the information or sources of information

they need as quickly and easily as possible. Online systems directly accessible by non-professional end users will be important tools in their efforts to attain this goal.

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Standards for a User-System Interface Language in Online Retrieval Systems: The Challenge and the Responsibility

Atherton, Pauline

Online Review, 2, 1, 57-61 Mar 1978

It is proposed that the conversational language used in interactive retrieval systems should become standard, at least as far as the technical terms and symbols used by the user are concerned. If that effort is successful, a standards effort in the area of a code of practice or recommended methods for operation could be developed. (Author)

*EJ274713 IR510808

ASK for Information Retrieval: Part II. Results of a Design Study.

Belkin, N. J.; And Others

Journal of Documentation, v38 n3 p145-64 Sep 1982

Reports on methodology and results of design study for an interactive information retrieval system funded by British Library Research and Development Department which will determine structural representations of anomalous states of knowledge (ASKs) underlying information needs. Problem statements, abstracts used, and text analysis are highlighted. References and appendices are provided. (EJS)

*EJ216494 IR507734

Education and Training for Computer-Based Reference Services: Review of Training Efforts to Date.

Bourne, Charles P.; Robinson, Jo

Journal of the American Society for Information Science, v31 n1 p25-35 Jan 1980. Reprint: UMI

Discusses issues regarding training for computer-based reference services, including who is to be trained and who is responsible for programs. Available training materials service suppliers, database

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*An asterisk before a citation indicates that the item also appears in the Reference List.

suppliers, library schools, and extension training, and summarizes the training offered to date by search are also considered. (Author/FM)

*EJ273024 IR510868

Can a Standard for an Online Common Command Language Be Developed?

Cochrane, Pauline A.

Online, v7 n1 p36-37 Jan 1983. Reprint: UMI

This working paper from the American National Standards Committee Z-39, Subcommittee G on Standard Terms, Abbreviations and Symbols for Use in Interactive Information Retrieval discusses the issue of standardization for command languages used in interactive online searching of bibliographic databases. (EJS)

*EJ263441 IR510087

"Friendly" Catalog Forgives User Errors.

Cochrane, Pauline A.

American Libraries, v13 n5 p303-06 May 1982. Reprint: UMI

Describes the features and operations of a user-searchable online catalog called PaperChase which was developed and implemented for the retrieval of medical literature by physicians at Beth Israel Hospital in Boston. Interaction with the system and use of the catalog during its first year of operation are discussed. (JL)

ED215683 IR010146

Measurement and Improvement of Subject Specialists Performance Searching Chemical Abstracts Online as Available on SDC Search Systems.

Copeland, Richard F.; And Others

Bethune-Cookman Coll., Daytona Beach, FL.

Jun 1980 142p.

EDRS Price - MF01/PC06 Plus Postage.

The first phase of a project to design a prompting system to help semi-experienced end users to search Chemical Abstracts online, this study focused on the differences and similarities in the search approaches used by experienced users and those with less expertise. Four online searches on topics solicited from chemistry professors in small colleges--the target group for the prompting system--were conducted by each of the 12 participants, who were divided into three groups on the basis of their prior experience. Each participant received a packet of materials introducing the project, searching, and search aids, and SDC's chemistry manual, and a slide/tape presentation was shown at the time of the test. It was found that,

for novice searchers, problems in interacting with the computer overshadowed all other concerns; semi-experienced searchers relied heavily on natural language searching; and experienced searchers focused on exploiting the structure of Chemical Abstracts within the capabilities of ORBIT. Problems with the search requests are discussed, as well as searching constraints and items peculiar to each searcher. Appendices include the pre-test handouts and narration for the slide/tape presentation, background on the searchers, search forms and search requests, online interaction, and searchers' comments. (RBF)

*EJ228368 IR508254

End User Education: A Design Study.

Elias, Arthur W.; And Others

Online Review, v4 n2 p153-62 Jun 1980

Traces the history of distribution form and access control for scientific and technical information; describes the findings of a Biosciences Information Service (BIOSIS) design study of end-user education and training programs in information resources; and presents a planning structure and some scenarios for end-user education. (Author/JD)

*EJ254061 IR509561

Is There a Future for the End User in Online Bibliographic Searching?

Faibisoff, Sylvia; Hurych, Jitka

Special Libraries, v72 n4 p347-55 Oct 1981. Reprint: UMI

Examines the probability and impact of an increase in end-user searching of online databases on librarians and library education. The problems of end-user searching are discussed, new developments in online access are reviewed, and recommendations for the education of the end-user are made. Included are 25 references. (JL)

*EJ240890 IR508785

Online Searching: Measures That Discriminate among Users with Different Types of Experiences.

Fenichel, Carol Hansen

Journal of the American Society for Information Science, v32 n1 p23-32 Jan 1981. Reprint: UMI

Describes a study conducted to identify the differences among the searches of users of online systems who have different amounts of overall experience, and the differences between the searches of persons with and without experience on the database being searched. Twenty-five references are cited. (FM)

EJ264823 IR510249

A Relational Database System for Student Use.

Fertuck, Len

Computers and Education, v6 n3 p295-98 1982

Describes an APL implementation of a relational database system suitable for use in a teaching environment in which database development and database administration are studied, and discusses the functions of the user and the database administrator. An appendix illustrating system operation and an eight-item reference list are attached. (Author/JL)

*EJ234703 IR508596

On-Line Catalogs at the Reference Desk and Beyond.

Ferguson, Douglas

RQ, v20 n1 p7-10 Fall 1980. Reprint: UMI

Briefly reviews the current developments in public access catalogs and poses questions for the public service librarian. (FM)

EJ281369 IR511271

End-User Training in the Use of a Small Swedish Database.

Fjallbrant, Nancy; And Others

College and Research Libraries, v44 n2 p161-67 Mar 1983. Reprint: UMI

Describes how group of end users (engineering undergraduates) at Chalmers University of Technology were trained to perform interactive online searching on BYGGDOK, a small, specialized Scandinavian database. Goals and objectives of the instruction, teaching methods, evaluation, and comparison of searching between end users and intermediaries are noted. Ten references are provided. (EJS)

*EJ192793 IR506104

The User—Cordial Interface.

Goldstein, Charles M.; Ford, William H.

On-Line Review, v2 n3 p269-75 Sep 1978

The contradictory nature of the phrase user-oriented interface (UOI) as commonly applied to retrieval systems is discussed, and a different approach to the problem made feasible through improvements in the technology is described. (Author/JPF)

*EJ271540 IR510681

Experiences in Training End-User Searchers.

Haines, Judith S.

Online, v6 n6 p14-23 Nov 1982

Describes study of chemists in the Chemistry Division, Organic Research Laboratory, Eastman Kodak Company, as end-user searchers on the DIALOG system searching primarily the "Chemical Abstracts" database. Training, level of use, online browsing, types of searches, satisfaction, costs, and value of end-user searching are highlighted. Three references are provided. (EJS)

*EJ261860 IR509899

Online Catalogs: Coping with the Choices.

Horny, Karen L.

Journal of Academic Librarianship, v8 n1 p14-19 Mar 1982. Reprint: UMI

Discusses and compares some online catalog systems actually in operation in terms of self-service usability; number, choice, and formulation of access points; record content and display; database content; connections to technical processing and circulation; number and location of terminals; equipment and software features; and cost. (Six references). (RAA)

*ED 195 275 IR 009 054

On-Line Public Access to Library Bibliographic Data Bases: Developments, Issues, and Priorities. Final Report.

Kaske, Neal K.; Ferguson, Douglas

Ohio Coll. Library Center, Columbus.; Research Libraries Group, Branford, Conn.

Sep 1980 79p.

EDRS Price - MF01/PC04 Plus Postage.

This report describes project activities designed to identify the critical issues and problems in designing and developing library bibliographic retrieval systems for direct patron use. The results of a survey, an issues analysis paper, and a working session indicate four priority areas for study and action: user and use characteristics, interface characteristics, the library environment, and the computing environment. Recommendations made by the working session participants highlight the consensus of their concerns--the analysis of user requirements and behavior, the monitoring of existing public access systems, the development of materials for cost management, and the development of distributed computing and system links. A

summary and analysis of participant developed definitions of an online catalog, a summary of existing and developing systems, and detailed tabulations are appended. (Author/RAA)

*EJ183718 IR504970
Evaluation of Information Retrieval Systems: A Decision Theory Approach
Kraft, Donald H.; Bookstein, Abraham
Journal of the American Society for Information Science, 29, 1, 31-40 Jan 1978. Reprint: UMI
The Swets model of information retrieval as a decision theory model is reviewed. (Author)

EJ256684 IR509643
The Management of Online Resources: Problems and Opportunities.
Lewis, D. A.; Adkins, R.
Online Review, v5 n5 p367-76 Oct 1981
Describes the management of online information services at ICI Plastics Division in terms of control and development, reviews implications for higher management, and identifies problems and opportunities related to manpower, money, materials, machinery, and time. Project RADIUS (Rapid Access to Data and Information by Untrained Scientists) is also briefly described. (RBF)

*ED212286 IR009993
Subject Access in the Online Catalog.
Mandel, Carol A.
Aug 1981 31p.
Sponsoring Agency: Council on Library Resources, Inc., Washington, D.C.
EDRS Price - MF01/PC02 Plus Postage.
This review of the research on subject access to library collections focuses on the problems of and prospects for improved online subject access to library collections. Summaries of the general findings of studies on library catalog use and catalog users and some reasons for the frequent failure of subject searches in library catalogs are followed by a discussion of the use of "failure analysis" as a technique in studies of automated information retrieval systems. The advantages and disadvantages of free text searching are reviewed, the feasibility of using the Preserved Context Indexing System (PRECIS) to supplement Library of Congress Subject Headings is briefly considered, and some of the conclusions drawn from studies

of library users' needs are presented. Research on the enrichment of cataloging records using free text descriptors, on enhancing currently used subject access systems such as Library of Congress Subject Headings, and on ensuring the effectiveness of the user interface with an online catalog is also discussed. Six recommendations are made for the improvement of subject access in online catalogs, and a 41-item reference list is included. (JL)

EJ (to be assigned)

An experimental comparison of the effectiveness of computers and humans as search intermediaries.

Marcus, Richard S.

Journal of the American Society for Information Science, v34 n6 p381-403 Nov 1983. Reprint: UMI.

The findings of a study of 16 end users new to CONIT (COnnector for Networked Information Transfer), who conducted searches on 20 different topics using the CONIT system and searches on the same topics working with trained human intermediaries searching directly, indicate that experimental intermediary techniques are now capable of providing search assistance whose effectiveness at least approximates that of human intermediaries in some contexts. (BBM)

ED229009 IR050162

Investigations of Computer-Aided Document Search Strategies.

Marcus, Richard S.

Massachusetts Inst. of Tech., Cambridge. Laboratory for Information and Decision Systems.

1 Sep 1982 74p.

EDRS Price - MF01/PC03 Plus Postage.

Controlled experiments were conducted with an enhanced experimental intermediary system, CONIT (COnnector for Networked Information Transfer), to test how effective such a system could be in assisting end users in online searching of medical and biomedical literature. A total of 16 end users, none of whom had previously operated CONIT or any of the four bibliographic retrieval systems used in the study, performed searches on 20 different topics with no assistance other than that provided by CONIT itself (except to recover from machine and software problems). The same topics were then searched by human expert intermediaries (librarians) with the end users present. Sometimes CONIT and sometimes the human expert were clearly superior in terms of such parameters as recall and search time. In general, however, end users searching alone with CONIT achieved somewhat higher online recall at the expense of

longer session times. It was concluded that advanced experimental intermediary techniques are capable of providing search assistance whose effectiveness at least approximates that of human intermediaries in some contexts. Details of the enhanced CONIT system and its costs are also discussed, as well as the possibilities for even more advanced intermediary systems, including those which perform automatic database selection and simulate human experts. A 60-item bibliography is provided. (Author/ESR)

ED142180 IR004971

Computer Interfaces for User Access to Heterogeneous Information-Retrieval Systems.

Marcus, Richard S.; Reintjes, J. Francis

Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

Apr 1977 81p.

EDRS Price - MF01/PC04 Plus Postage.

A translating-computer-interface approach to providing a common, or virtual-system, mode of access to a network of heterogeneous online bibliographic retrieval systems has been investigated. Enhanced access to such systems by end users has been demonstrated through test usage of an experimental interface. A table-driven, rule-based message interpreter that provides a dynamic and flexible means for handling the automation of the interconnection of computer and human retrieval protocols has been found useful in implementing the interface. Experimental analysis has demonstrated the success of various computer-assisted instructional techniques as well as indicated basic tradeoffs and limitations in their implementation in working systems. Further development of interface systems appears promising and possibilities for further research have been outlined in a number of areas. (Author)

ED190104 IR008588

Experiments and Analysis on a Computer Interface to an Information-Retrieval Network.

Marcus, Richard S.; Reintjes, J. Francis

Massachusetts Inst. of Tech., Cambridge. Laboratory for Information and Decision Systems.

Apr 1979 133p.

EDRS Price - MF01/PC06 Plus Postage.

A primary goal of this project was to develop an interface that would provide direct access for inexperienced users to existing online bibliographic information retrieval networks. The experiment tested

the concept of a virtual-system mode of access to a network of heterogeneous interactive retrieval systems and databases. An experimental translating computer interface named CONIT, that enables the virtual-system mode, was developed as a research test vehicle. The interface was designed to make the basic functions of three different bibliographic retrieval systems easy to use, even by inexperienced end users, by providing a simplified common command language coupled with extensive online instruction. Analysis of controlled experiments with end users indicates the probable success of operational interfaces using the virtual-system principle and other techniques demonstrated in the experimental interface. The research has also suggested that certain techniques implementable on an interface could enhance retrieval effectiveness for a wide class of users by aiding them in the development of search strategies. A project bibliography and references are included. (Author/RAA)

ED125533 IR003617

The Networking of Interactive Bibliographic Retrieval Systems.

Marcus, Richard S.; Reintjes, J. Francis

Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

Mar 1976 172p.

EDRS Price - MF01/PC07 Plus Postage.

Research in networking of heterogeneous interactive bibliographic retrieval systems is being conducted which centers on the concept of a virtual retrieval system. Such a virtual system would be created through a translating computer interface that would provide access to the different retrieval systems and data bases in a uniform and convenient way, even for the inexperienced user. An experimental interface, called CONIT, has been built to test the virtual system concept. Initial evaluation of CONIT, which connects four retrieval systems, suggests that the virtual system approach could be cost effective. Particular attention was focused on the requirements for a common command language, ease of use, and message interpretation and protocols in a networked interface. (Author/JY)

*EJ248944 IR509275

A Translating Computer Interface for End-User Operation of Heterogeneous Retrieval Systems. I. Design.

Marcus, Richard S.; Reintjes, J. Francis

Journal of the American Society for Information Science, v32 n4 p287-303 Jul 1981. Reprint: UMI

This first of two related articles by the same authors describes the philosophy, design, and implementation of an experimental

translating computer system, CONIT, whose purpose was to investigate techniques for simplifying access to, and operation of, bibliographic retrieval systems. Forty-one references are cited. (FM)

*EJ248945 IR509276

A Translating Computer Interface for End-User Operation of Heterogeneous Retrieval Systems. II. Evaluations.

Marcus, Richard S.; Reintjes, J. Francis

Journal of the American Society for Information Science, v32 n4 p304-17 Jul 1981. Reprint: UMI

This second of two related articles by the same authors evaluates the performance of an experimental translating computer system, CONIT, whose purpose was to investigate techniques for simplifying access to, and operation of, bibliographic retrieval systems. Forty-two references are cited. (FM)

*EJ208344 IR507114

The Computer as a Search Intermediary.

Meadow, Charles T.

Online, v3 n3 p54-59 Jul 1979

Presents the rationale behind and a description of the Individualized Instruction for Data Access (IIDA) system, which is intended to assist people in performing online bibliographic searches through the use of another computer as intermediary. (CWM)

*EJ271589 IR510740

A Computer Intermediary for Interactive Database Searching. I. Design.

Meadow, Charles T.; And Others

Journal of the American Society for Information Science, v33 n5 p325-32 Sep 1982. Reprint: UMI

Reports on the development of the Individualized Instruction for Data Access System (IIDA), a computer system designed at Drexel University, which serves as an intermediary enabling users to perform complex tasks on another computer. Capabilities of the instruction mode and assistance mode are discussed. Fifteen references are cited. (EJS)

EJ274730 IR510876

A Computer Intermediary for Interactive Database Searching. II. Evaluation.

Meadow, Charles T.; And Others

Journal of the American Society for Information Science, v33 n6 p357-64 Nov 1982. Reprint: UMI

Testing in an industrial setting of the Individualized Instruction for Data Access System--an intermediary system designed to train and assist users in conducting computer searches--demonstrates that end users can learn to do bibliographic searches through computer-assisted instruction that are as satisfactory as searches performed for them. References are listed. (EJS)

ED210026 IR009834

Individualized Instruction for Data Access (IIDA). Final Report.

Meadow, Charles T.; And Others

Drexel Univ., Philadelphia, Pa. Graduate School of Library Science.; Franklin Inst. Research Labs., Philadelphia, Pa.

22 Oct 1981 73p.

EDRS Price - MF01/PC03 Plus Postage.

The realization that the facilities available for the retrieval of scientific and technical information were being underutilized resulted in a project being undertaken by the Drexel University School of Library and Information Science to develop a computer intermediary capable of assisting users of scientific and technical information in the performance of online bibliographic searches. Individualized Instruction for Data Access (IIDA), the computer system developed during the project, operates in an instructional and an assistance mode, and can be used to train users to perform online searches or to aid users in search performance. The system employs a set of diagnostics which alert users to the strategic and syntactic errors they make during the search process. When IIDA was operational, a number of evaluations of the system were made, first using undergraduate computer science majors and experienced online searchers, then library science faculty and graduate students and undergraduate engineering students, and finally engineers at the Exxon Research facility in Florham Park, New Jersey. The evaluation studies indicated that individuals who had never done online searching were able, using IIDA, to do searches which produced satisfactory results. Detailed accounts of the design of the system, system operations, and the methodology of the evaluation studies are given, and the project bibliography is included. (JL)

*EJ208335 IR507105

Online Searching and Computer Programming: Some Behavioral Similarities (Or...Why End Users Will Eventually Take Over the Terminal).

Meadow, Charles T.

Online, v3 n1 p49-52 Jan 1979

Uses an analogy to computer programming to demonstrate that end user training for online bibliographic search systems will increase, lead to vastly increased use of online search systems, increase the understanding of end users, and reduce the amount of time professionals spend on routine tasks. (CWM)

EJ264736 IR510161

The Design of an Interactive Data Retrieval System for Casual Users.

Radhakrishnan, T.; And Others

Information Processing and Management, v18 n1 p23-32 1982

Describes an interactive data retrieval system which was designed and implemented for casual users and which incorporates a user-friendly interface, aids to train beginners in use of the system, versatility in output, and error recovery protocols. A 14-item reference list and two figures illustrating system operation and output are included. (JL)

*EJ179519 IR505170

The Probability Ranking Principle in IR.

Robertson, S. E.

Journal of Documentation, 33, 4, 294-304 Dec 1977

Discusses the principle that documents should be ranked in order of the probability of relevance for optimal retrieval. (Author/KP)

*EJ141605 IR503603

Relevance Weighting of Search Terms.

Robertson, S. E.; Sparck Jones, K.

Journal of the American Society for Information Science, 27, 3, 129-46 May-Jun 1976

Examines statistical techniques for exploiting relevance information to weight search terms. These techniques are presented as a natural extension of weighting methods using information about the distribution of index terms in documents in general. (Author)

*EJ240886 IR508774

Implications of Artificial Intelligence for End User Use of Online Systems.

Smith, Linda C.

Online Review, v4 n4 p383-91 Dec 1980

Reviews several studies which demonstrate how artificial intelligence techniques can be applied in the design of end user-oriented interfaces (which would eliminate the need for an intermediary) to existing online systems, as well as in the development of future generations of online systems intended for the end user. (Author/SW)

*EJ274781 IR510960

OL'SAM: An Intelligent Front-End for Bibliographic Information Retrieval.

Toliver, David E.

Information Technology and Libraries, v1 n4 p317-26 Dec 1982. Reprint: UMI

Discusses intelligent front-end processors designed to impose uniform standards on multiple databases and assist searchers, including motivation for development, prototypes from research community, commercial systems using microcomputers, capabilities and problems encountered in developing Franklin Institute's Online Database Search Assistance Machine (OL'SAM), and recommendations for further development. Sixteen references are cited. (EJS)

*EJ248933 IR509264

DIATOM: A DIALOG Simulator.

Waldstein, Robert

Online, v5 n3 p68-72 Jul 1981. Reprint: UMI

Describes DIATOM, an online bibliographic retrieval system designed and implemented at Syracuse University to teach search strategy and the use of DIALOG to library science students. System features and database storage considerations are explained. (FM)

*EJ271520 IR510661

Online Bibliographic Searching and Student Use of Information: An Innovative Teaching Approach.

Wozny, Lucy Anne

School Library Media Quarterly, v11 n1 p35-42 Fall 1982. Reprint: UMI

Provides description of use of libraries and library resources by ninth-grade students trained in online bibliographic searching and

conventional modes of accessing literature. Information is included on student use of types of resources, magazines, libraries, online searching, and student acceptance of direction from library media specialists. Six references are listed. (EJS)

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